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AUTHOR Kushler, Martin G.
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ABSTRACT

Energy conservation efforts targeted at high-school-age youth could produce immediate energy savings as a result of their actions and their influence on their families. Prior to their assumption of full adult roles, students could adopt an "energy ethic" having a lasting impact on society. Based on these beliefs, a multi-phase research effort was undertaken, including instructional intervention and attitude surveys, to determine the effects on youth of energy education. The data suggest that energy-conservation instruction has a significant effect on the attitudes and behaviors of high school students. Females were more positive toward conservation than males; older students and those with higher grade-point averages also had more positive attitudes. Further experimental research is needed to demonstrate the causal connection between education and energy-conservation attitudes and behaviors and to examine ways in which teenagers influence home energy-consumption patterns. (Author/CS)

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Energy Conservation: Three Years of Research on the Attitudes and Behaviors of High School Students[1]

by

Martin G. Kushler[2]

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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[2] Martin Kushler is the Educational Project Evaluator for the Energy Administration of the Michigan Department of Commerce.

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INTRODUCTION

In recent years the extent of the nation's energy problem and the need for energy conservation have become acutely obvious to policy makers and concerned citizens alike. In addition to the shock of the original 1973 Arab oil embargo, factors such as the continuing instability in the Middle East, domestic problems with the development of nuclear energy and synthetic fuels, and the ever-increasing cost of all types of energy have all contributed to the growing emphasis on conservation. Indeed, the highly respected Harvard Business School recently issued a detailed report (Stobaugh and Yergin, 1979) strongly pointing to the use of conservation and solar energy as our most appropriate energy policy for the rest of this century.

Although the role of psychological research in the solution of the energy problem has received little attention or support as compared to the technical, production-oriented approaches attempted by the physical sciences (Winett, 1976; Ferber, 1977; Shippee, 1978; Becker, Seligman and Darley, 1979) there is reason for optimism in the near future. The new emphasis on conservation and renewable resources, if truly adopted as a major segment of national energy policy, should provide a key role for social scientists in both basic and applied aspects of energy research and program development (Winett, 1979).

High School Age Youth as a Target Population

One area of obvious potential for such social science involvement and contribution is the educational system. The rationale for interest in this area is two-fold. First, efforts targeted at high school age youth, for example, could produce immediate energy savings both as a result of their own actions and as a result of actions they might influence their families to take. Second, efforts targeted at students prior to their assumption of full adult roles and responsibilities could help instill an "energy ethic" which could have a lasting impact in terms of wise future decisions concerning energy use.

Unfortunately, recent assessments of the situation indicate that little research or policy planning activity is being undertaken in this area (Education Commission of the States, 1978), and furthermore, that America's students are lacking in basic knowledge of energy and energy conservation, and expect to be able to continue to depend on high energy use (National Assessment of Educational Progress, (NAEP) 1978). In addition, each of these studies noted that although some isolated examples of positive activity in energy conservation education could be found, there was a lack of cooperation and communication which impeded significant overall progress.

Further information about the energy conservation attitudes and behaviors of youth, however, is somewhat scarce. Although a fair amount of study of environmental attitudes has occurred, relatively little research has been published concerning the attitudes of youth toward energy and energy conservation. Some of those studies that have been reported, although often limited in scope, are useful to consider.

Ayers (1977) used a 17-item Likert-type questionnaire, developed by the Pennsylvania Department of Education, to measure the attitudes of fifth, sixth and seventh grade students toward electrical power generation and its environmental impact. A total of 496 students completed the instrument. Ayers found that the students had some understanding of the long term problems associated with the energy shortage, including the problems associated with producing electricity from nuclear and fossil fuels. Ayers also reported that females and older students tended to be more cautious in their feelings about the production of electricity.

Fazio and Dunlop (1977) surveyed undergraduate non-science majors in an attempt to measure general background knowledge of energy related matters. Similar to the NAEP study previously cited, they found that students had a poor knowledge of energy facts and concepts (although they reported that the use of

energy workshops resulted in significant cognitive gains). It is interesting to note that other authors, in the closely related field of environmental education, have similarly found various educational interventions to be useful in increasing students' positive attitudes toward the environment (e.g. Hounshell and Ligget 1976; Aird and Tomera 1977; etc.).

Collins, et al (1979) examined the effects of an educational intervention on the attitudes of younger students toward energy conservation. They studied the impact of a nine day energy conservation field trip program on 431 youths in grades four through six, and discovered significant gains in positive attitudes toward energy conservation. In addition, they found that the amount of attitude change was not related to sex, grade level or community type.

Finally, Kuhn (1979) presented the results of a study he conducted in which 413 high school students (grades 10-12) were surveyed with an opinionnaire concerning energy related issues. He reported a number of interesting findings, particularly involving differences between males and females. He found that females tended to be more positive toward conservation, both in terms of recognizing the importance of individual efforts to conserve as well as in the necessity for government regulation to encourage conservation. In contrast, males were more likely to show faith in technology as a solution to the energy problem, including being more positive toward nuclear power. Interestingly, in investigating some related issues, Kuhn found that although males were more likely to report that they attempted to keep informed on current issues, there was no significant difference in the extent to which males and females reported considering the future implications of their decisions. Kuhn also found that students who rated themselves as better informed tended to be the most strongly supportive of policies consistent with sound energy conservation and resource development programs.

In summary, however, with a few exceptions, there is a general lack of information about the energy conservation attitudes and behaviors of an important energy consuming group, the American teenager. The data that is available tends to show that much more could be done to help assure that this consuming group uses energy more wisely. It is hoped that the present paper will contribute to the base of information about this age group as well suggest ways that energy conservation attitudes and behaviors might be positively impacted.

The Current Research

The series of studies to be discussed in this paper provide a substantial first step toward the thorough examination of the potential for targeting America's youth in the national effort at energy conservation. A two year program of research, funded by the Federal Department of Energy and administered by the Energy Extension Service (EES) of the Michigan Department of Commerce, examined a variety of issues involving the energy conservation attitudes and behaviors of high school age youth.

In particular, three major research efforts will be discussed in this paper. Two of these projects were in the form of large scale field experiments within Michigan, while the third was a survey research effort conducted in eight states throughout the country. The results to be discussed in this paper represent experimental as well as correlational data gathered in surveys of participants in these three studies.

METHOD

Overview: The Michigan Multiple Phase Project

The Youth Project of the Michigan Energy Extension Service was conceptualized and planned as a longitudinal program of service and research. As such, several distinct phases of programming were designed to investigate

different aspects of youth energy conservation attitudes and behavior and how they might be influenced. Three separate phases of this project have been completed and will form the basis of this report. Rather than attempt to construct a single overall description of methods, the following combined descriptions of the individual projects are provided.

Subjects

For the two field experiments, a population of 124 high schools in 15 counties throughout Michigan was identified with the assistance of the Michigan Department of Education. The 15 counties were selected to contain a good mix of rural, suburban and urban areas. The high schools themselves include a mix of approximately 80 percent public and 20 percent private (religious) schools. The schools range in size from 150 to 2200 students and include a variety of racial and socioeconomic mixes as well. Hence this study should provide for good generalizability to high schools in almost any setting. In addition, in order to provide for the soundest methodological procedures, these schools were randomly assigned to treatment and control conditions. Altogether, over 40,000 students from grades 9 through 12 were surveyed with the Youth Energy Survey (YES) instrument during these two field experiments.

In the national survey study, sampling considerations began at the level of selecting appropriate states for participation. The 48 states of the continental United States (Alaska and Hawaii were excluded) were divided into four quartiles based on average heating degree days. Then, within each quartile the 12 states were rank-ordered based on their representativeness of that quartile in terms of weather and eight other demographic characteristics. Two of the most representative states from each quartile were then selected for participation in the study. (See Jeppesen, 1979, for a more detailed description of the procedure utilized.) The eight states participating included (in order of warmest to coolest climate); Alabama, North Carolina, Missouri, Delaware,

Nebraska, Washington, South Dakota and Wisconsin. In all, a total of over 40,000 students from 161 high schools across these states were surveyed.

Measures

The primary measurement instrument used was the Youth Energy Survey, a pre-printed, machine scorable questionnaire containing a 45-item Likert-type scale of energy conservation related attitudes and an 18 item set of self-reported energy conservation behaviors. This instrument has undergone extensive field testing to demonstrate a high level of reliability and predictive validity. (See Stevens and Kushler, 1979, for a description of the development and testing of this instrument.)

The overall attitude scale, which is most frequently utilized to indicate energy conservation attitude, has consistently demonstrated high reliability (Chronbach's alpha $\geq$ .90) and validity (significant correlations in the range of .20 to .40, with: teacher ratings of student energy conservation attitudes; students' self-report of energy conservation behavior; and student behavioral data from a variety of energy conservation tasks at school and at home) in numerous small and large scale field studies. In addition, a variety of background information about respondents was obtained in the questionnaire, including certain demographics and information about educational background. Validity of these variables, as well as the self-report of behavior items, has been demonstrated through follow-up telephone interviews with students and parents of students who completed the questionnaire (see Condon and Davis, 1979). Finally, the teachers of each class surveyed were also given written questionnaires and/or telephone interviews to obtain independent information about any exposure of students to energy conservation education.

Procedures

Phase I: Testing a broad range of approaches. The first phase of the Youth Project was intended to test a wide range of possible methods for helping to create an "energy conservation ethic" in high school youth. Four diverse intervention strategies were selected: providing workshops to train teachers to teach energy conservation; facilitating presentations by students to other students; providing drama (theater) presentations to students (e.g. acting out various energy scenarios); and providing a large scale assembly program on energy (The "Energy Today and Tomorrow" program developed by Oak Ridge Associated Universities, Oak Ridge, Tennessee). Participating schools were randomly assigned to receive one of these strategies or no contact at all. The four assigned strategies were carried out during the winter of the 1977-78 school year and students were surveyed with the YES instrument in May of that school year. (Please see Stevens, Kushler, Jeppesen and Leedom, 1979, for more details on this study.)

Phase II: Testing strategies for teacher training. Based on the results of the first phase, it was decided to target the second phase of the Youth Project toward investigating strategies designed to get teachers to teach about energy conservation in their classes. Once again, four different strategies were selected for testing: a "teacher consultation" strategy, where an extension agent consulted individually with teachers in the schools; a "committee" consultation strategy, where an extension agent consulted with teachers and also attempted to get them to form a conservation committee in their school; a "workshop" condition, where teachers were invited to attend a half-day workshop on teaching energy conservation; and a "task-oriented" workshop condition, where teachers attended half-day workshops which included, in addition to the same package of materials provided in the other three conditions, materials and a presentation on the "task" strategy of having students actually engage in energy conserving behavior as a part of their school assignments on energy.

The same four regions of the state were utilized for this experiment, which was conducted the year after the first phase. Schools were once again randomly assigned to four treatment and one control condition. The treatments were all conducted during fall of 1978 and students and teachers were surveyed at the end of the first semester of the 1978-79 school year. (Please see Kushler and Davidson, 1979, for a more detailed description of the Phase II study.)

Phase III: A national survey of youth. Based on the encouraging findings and successful methodology of the earlier Youth Project activities, the U.S. Department of Energy granted additional funds to Michigan to do a survey of a national sample of students. For this study, eight states were carefully selected on a number of criteria to help assure their representativeness of the nation as a whole. Four regions of the continental United States were created based on various weather characteristics. Within each of these four regions, two states were selected based on their representativeness of that region in terms of weather data and various population demographic characteristics. Since this project was designed solely as a survey, intended to begin to establish a national youth conservation attitude and behavior data base, no educational interventions were conducted by the Michigan EES in this project. Students in all eight states were surveyed during the winter of the 1978-79 school year.

RESULTS

For the purposes of this paper, the results obtained from the three studies described above will be divided into two major categories. First, the basic survey results will be outlined in terms of existing energy conservation attitudes and behaviors and their relationship to various student characteristics. Following this, project results will be described which relate to energy conservation education and its effect on student attitudes and behaviors. For reasons of space as well as conceptual organization, results will be aggregated across the three studies and presented in overall summary tables. Additional

detail about some of the more interesting findings will be provided in the discussion section.

Energy Conservation and Student Characteristics

In all, a total of eleven demographic and descriptive variables obtained from the questionnaire (sex, grade, number of persons in the home, number of bedrooms, type of home, whether or not the youth owns their own car, type of car youth owns, number of cars the family owns, size of largest car the family owns, size of community the youth lives in, and the student's grade point average) were examined for their relationship to student energy conservation attitudes and behaviors. Certain other obviously important demographic variables (e.g. family income, parents' occupation and race) unfortunately had to be omitted, due to their potentially sensitive nature. Nevertheless, these studies do provide a fairly detailed look at the energy conservation attitudes and actions of high school students and represent some of the most comprehensive such efforts conducted in the United States to date. These results are presented in Table 1. (Note: statistical significance as referred to in the tables was determined by F-tests using the $p < .0001$ level of probability.)

Energy Conservation and Exposure to Energy Education

The data to be described in this category include the experimental results from Phase I and Phase II of the Michigan projects as well as correlational survey results from all three studies. For the latter, a total of five items from the questionnaire were examined (whether or not the student received energy education; the number of hours of energy conservation instruction received; the number of different courses in which a student had received instruction; whether or not the student had been given a school "task" assignment to actually carry out an energy conservation activity outside of class and the number of pages the student had read concerning energy in the past week). These data were compared to energy conservation attitudes and behaviors measured by the YES instrument. The results are presented in Table 2.

Table 1

Relationship of Demographic and Descriptive Variables to Energy Conservation Attitudes and Behaviors

Variables	Significant Findings			Comments
	Phase 1 (Michigan) 1977-78	Phase 2 (Michigan) 1978-79	National (8-States) 1978-79	
Sex	Yes	Yes	Yes	Females consistently more positive toward conservation. Males more positive toward technology and nuclear power, much less positive toward automotive conservation. Behaviors split with males more likely to do mechanically or physically involved tasks.
Grade	Yes	Yes	Yes	Attitudes and behaviors tend to be more positive at each successive grade level for grades 9-12. (See discussion for further comments.
Number of persons in the home	No	No	No	In study #1, a slight trend was observed toward a larger number of siblings in the home being associated with lower conservation attitudes. No relationship for number of adults in the home. The second and third studies just looked at number of persons in the home and found no significant differences.
Size of home (# of bedrooms)	N/A	No	No	A slight trend in study #2 toward more positive attitudes for students from larger sized homes. No relationship for behaviors.
Type of Home	Yes	No	Yes	Students who live in single family houses are the most positive group, followed by those in apartments or duplexes followed by those in mobile homes. Behaviors are not quite significant.

Table 1 continued

Variables	Significant Findings Phase 1 (Michigan) 1977-78	Phase 2 (Michigan) 1978-79	National (8-State) 1978-79	Comments
Youth ownership of a car	Yes	Yes	Yes	Students who own their own car are less positive toward energy conservation and particularly toward automotive conservation. Trend not quite significant for behaviors (see discussion). Effects persist for both males and females but stronger for males.
Size of car youth owns	Yes	Yes	Yes	Students who own sub-compact cars have the most positive conservation attitudes, followed in direct descending order by owners of compacts, mid-size and full size cars. Behaviors follow a similar, but not quite significant trend in all three studies.
Number of cars owned by family	No	No	No	No strong pattern but consistent trend toward families with more than 2 cars being less positive toward conservation.
Size of largest car owned by family	Yes	Yes	Yes	Attitudes tended to reveal the same pattern of results as for size of car the youth owns. Behaviors were also in the same trend but not quite significant.
Size of Community	N/A	N/A	Yes	Rural residents scored lowest on both attitudes and behaviors. Suburban residents had the most positive attitudes. City and suburban youth shared the lead in conservaton behaviors.
Student's grade point average	N/A	N/A	Yes	Strongly significant linear relationship toward students with high grade point averages having more positive attitudes toward conservation and performing more conservation behaviors.

Table 2

Relationship of Exposure to Energy Education to Energy Conservation Attitudes and Behaviors

Variable	Significant Findings: Phase 1 (Michigan) 1977-78	Significant Findings: Phase 2 (Michigan) 1978-79	Significant Findings: National (8-States) 1978-79	Comments
Type of communication used to reach students	Yes	N/A	N/A	None of the four strategies used (teacher workshops, student to student presentations, small drama presentations, large scale assemblies) could demonstrate positive impact on students as compared to control groups. The large scale assembly had a slight negative impact. A correlational finding suggested usefulness of more class hours spent on energy conservation.
Type of intervention to use with teachers	N/A	Yes	N/A	Four different approaches to teachers were tested (see Method section). All four were strongly effective at getting teachers to teach as compared to a randomly assigned control group. The teacher workshop with a "task-oriented" approach produced the most positive student attitudes and behaviors.
Energy conservation instruction	Yes	Yes	Yes	Students who received energy conservation instruction were more positive in attitudes and behaviors than students who had not received instruction.
Number of hours of energy conservation instruction	Yes	Yes	Yes	A consistent positive relationship was observed in all three studies whereby more hours of instruction were associated with higher attitude and behavior scores.
Number of courses in which energy conservation was included	N/A	Yes	Yes	Conservation behaviors appear to improve significantly with each additional course exposure, attitudes, improve until leveling off after three courses.

Table 2 continued

Variable	Significant Findings			Comments
	Phase 1 (Michigan) 1977-78	Phase 2 (Michigan) 1978-79	National (8-States) 1978-79	
Energy conservation "task" assignment	N/A	Yes	Yes	Students who had received an energy conservation "task" assignment from school scored higher on energy conservation attitudes and behaviors.
Number of pages read in past week concerning energy conservation	Yes	Yes	Yes	A consistent positive relationship was observed in all three studies whereby more pages of energy conservation material read was associated with higher attitude and behavior scores.

Regression Analyses

In an effort to further examine the voluminous survey data, regression analyses were performed using the eleven demographic variables and the five educational variables as predictors of energy conservation attitudes and behaviors. As is often the case in large scale survey research, the strength of relationship between predictor and criterion variables, in terms of Pearson Correlation Coefficients, was fairly low. In this case, with the very large sample sizes available, the r values of the significiant predictors generally ranged from .10 to .25. Nevertheless, the regressions were easily significant and the demographic and educational variables together were able to account for approximately 10 percent of the variance of both conservation attitude score and conservation behavior score.

It is interesting to note that demographic variables accounted for approximately two-thirds of the explainable variance for attitudes, but that for energy conservation behaviors, almost all of the explainable variance was attributable to the educational exposure variables. This suggests, somewhat surprisingly, that educational interventions may in fact have even more impact on conservation behaviors that on simple attitudes. This is an encouraging finding in terms of the potential practical impact of educational interventions on the nation's energy problems.

DISCUSSION

Demographic and Descriptive Variables

One of the most commonly examined demographic variables is that of sex of the respondent. In these studies it was found that females were clearly more positive toward energy conservation than males. This was found to be true across all grade levels studied. It is interesting to note that this finding has not only been strongly replicated in all of the student surveys conducted

during this project but is also quite consistent with findings from many national surveys of energy conservation and environmental attitudes, in which females are generally found to be more positive than males (Farhar, et al 1979).

However, the YES instrument also allows the advantage of taking a somewhat closer look at this variable, due to the fact that it contains several different conservation related content areas or "sub-scales." Although space does not permit the detailed presentation of these findings, they can be briefly summarized as follows: females were found to be more favorable to the general concept of energy conservation, tended to feel more strongly that conservation was feasible, expressed more personal responsibility for conserving, and were much more favorable toward automotive conservation. Males, on the other hand, tended to be more favorable toward technological solutions, including nuclear energy. These findings parallel closely those reported by Kuhn (1979), as discussed earlier in this paper.

A similar situation was observed in the specific energy conservation "tasks" section. Females were higher on the more general tasks, such as talking to parents, and on the automotive related tasks. Males were higher on the more physical or mechanically related tasks such as caulking, weatherstripping and insulating. The balance between these types of tasks in the questionnaire is probably what accounted for the finding of no significant difference between males and females on the overall task score.

Another interesting finding was the grade level results. When considering these findings, a question naturally arises as to what accounts for the observable trend of higher grades having more positive scores. Is it a part of a developmental process; due to increased exposure to the educational system; due to some historical event(s); or a result of some combination of those three factors? These questions are heightened when one also considers the preliminary results of some work EES has done with middle school students. What has emerged

is a fluctuation over grade level; fifth and sixth graders have attitude scores comparable to the later high school grades; but seventh through ninth graders for some reason show substantially lower attitude scores. Much further research is needed, including repeated surveys over time, before these interesting trends can be adequately understood.

The finding concerning grade point average is also an interesting one and is consistent with numerous studies which link higher educational levels with higher energy awareness and favorability toward conservation (Farhar, et al 1979). Similarly, both family socioeconomic status and student IQ have been found to be positively related to environmental awareness and attitudes (Horvat and Voelker 1976).

The other major significant findings in terms of descriptive variables primarlily revolve around the automobile. These differences cannot be explained away by sex differences in car owners, nor by simply looking at the automotive related items in the attitude scale. One further interesting point to consider is that these findings lend behavioral evidence to the validity of the YES attitude scale (e.g. persons with more positive energy conservation attitudes drive smaller cars and visa versa).

Finally, there were several demographic and descriptive variables which were not particularly related to conservation attitudes or behaviors, including; the number of persons who live in the home, the size of the home and the number of cars owned by the family. There was a slight trend toward students from families with more cars having lower scores on both energy conservation attitudes and behaviors. Unfortunately, it is difficult to interpret the findings on these items because they are affected by family income and occupation, two variables on which no data was gathered.

Exposure to Energy Conservation Education

Table 2 presents the major findings of this study in terms of the effects of energy conservation education. Much of the data is encouraging and deserves some discussion.

The Phase I results are obviously the least encouraging of the project. Still, in a field of investigation that was in its early stages of development, such a study provided valuable future direction. Although only one example of each broad type of methodology was tested (e.g. drama presentation, large scale assembly, etc.) the authors combined the experimental findings with logical hindsight and concluded that it was probably unrealistic to expect such diffuse, low-contact, large-group methods to positively impact such complex concepts as energy conservation attitudes and behaviors.

The Phase II results were much more encouraging, particularly in the demonstration of the ability to influence teachers to teach about energy and energy conservation in their classes. It was found that this could successfully be done through a variety of different consultation and workshop approaches. One area that was identified for further research, however, was the issue of how and what to teach to achieve the most effectiveness. Many "energy" materials and curricula currently available were found to have no positive impact on energy conservation attitudes and behaviors. The single most promising strategy, referred to previously, was found to be the "task-oriented" approach to conservation education, In this approach, the student is asked to actually engage in an energy conserving behavior and to monitor or discuss the results in terms of energy savings. This strategy combines the best features of the impact of task experienced and self-perception on attitudes (Breer and Locke 1965; Bem 1972), monitoring and feedback (e.g. Seligman and Darley 1977; Becker 1978) and the incremental adoption of new behaviors represented by the foot-in-the-door approach (Scott 1977). For further information the reader is referred to Leedom (1979).

Finally, the results in terms of the four survey variables regarding energy conservation exposure are also very positive. As can be seen in Table 2, the results consistently show that students who receive energy conservation instruction have more positive attitudes and report having performed more energy

conservation behaviors. Furthermore, there is a solid indication that additional exposure to energy conservation instruction, both in terms of the number of hours of instruction and in the number of different courses in which conservation topics are taught, will produce additional gains in attitudes and behaviors. Once again, the fact that a student received an energy conservation activity assignment is also related to positive attitudes and behaviors.

One further piece of information may be helpful at this point. It is important to note that the data presented in this study is once again backed up by additional validity data. In this case, the teachers of the students involved in the Phase II study were surveyed for their estimates of the amount of energy conservation instruction provided. The student attitude and behavioral data was then computed for each of their classes and that student data was analyzed according to the teacher's estimates of instruction provided. The data on over 600 classrooms surveyed indicates an almost identical pattern of results to that obtained through the student estimates, in terms of the effects of whether or not conservation instruction was provided, how many hours of such instruction was provided, and whether or not an energy conservation activity was assigned. Such cross-source validation is important in increasing the confidence one can place in the results of these survey studies.

Energy Impact

Finally, it is also useful to consider the parameters of actual energy savings attainable through an educational intervention directed at this age group. Because it was impossible to directly monitor energy consumption of households in this large scale study, self report data from students must be used to provide some estimates. This is necessarily a risky venture. However, research with other target populations within this age group has shown the ability of self-report measures of behaviors to demonstrate desirable reliability and validity characteristics (Blakely, Kushler, Parisian and Davidson, 1980).

Furthermore, as discussed previously, great care has been taken to maximize the reliability and validity of the particular instrument used to obtain this data.

Keeping these factors in mind, the data for the 8 parent and 10 youth energy conservation tasks was examined relative to various amounts of energy conservation instruction received by students. As an example, by extrapolating the data it was found that for a typical high school of 1,000 students, the exposure of all students to five to ten hours of energy conservation instruction in one of their classes would likely result in enough additional energy conserving tasks to save 2.14 trillion Btu's per year.[1] This is equivalent to over 15,000 gallons of heating oil or 17,000 gallons of gasoline. While it is important to remember that these savings are projections only, they do give an indication of the potential for positive impact that exists in this area.

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[1] Details of the Btu calculation procedures used will soon be available in the form of a technical report and can be obtained by writing the author at the Michigan Energy Administration, 6520 Mercantile Way, Suite #1, Lansing, Michigan, 48910--Copies of other Energy Administration reports cited in this paper can also be obtained at that address.

SUMMARY AND CONCLUSIONS

In considering the results of these studies, two important points must be kept in mind. First, for the most part the results reported here are based on surveys of students and, as such, are subject to all the methodological limitations of survey research. In particular, the survey results reported here must be considered correlational findings only, and not causal (e.g. one can observe the fact that having had energy conservation instruction is related to higher attitude and task scores in students, but one cannot claim to have demonstrated that the instruction produced the score differences. To do so would require, for example, taking two initially equivalent groups of students and instructing one group while not instructing the other, and then observing the differences). Also, the reader should be aware that the surveys discussed in this paper are not based on a statistically selected "probability sample" which can claim to be directly representative of the universe of high school students in the United States.

However, the second point serves to modify somewhat the warning implied in the first. That is, that this particular program of survey research is somewhat unique in the amount and extent of effort devoted to ensuring the quality of the data obtained. The YES instrument itself has undergone extensive reliability and validity testing and, in one case, the obtained student responses themselves were subjected to cross-source validation using teacher data. Also, the samples selected in Michigan, as well as the eight states chosen in the national study, were selected based on several criteria to improve their representativeness. These facts, plus the very large sample size and the consistency of most of the findings, do provide a fair amount of support for the generalizability of the results reported herein. All of these efforts do not change the fact that these results are based on survey data, but they should increase the confidence of the reader in the quality of the survey research conducted.

These caveats aside, the results of this study present some very interesting findings. In terms of demographics, it appears that females are more positive toward conservation than males, and older students are more positive than younger students (within grades 9-12). However, it is also interesting to note (although space did not permit the presentation of this data) that the positive responsiveness of students to energy conservation instruction does not seem to be particularly affected by sex or grade level. This is similar to the findings reported by Collins, et. al. (1979). Furthermore, the apparent effects of car ownership and size of car owned also persisted across sex and grade level. Those who own their own cars are less positive towards conservation than those who do not, and those who own large cars are less positive than those who own small cars.

However, the results with perhaps the most importance, and surely with the most public policy implications, are the findings concerning energy conservation instruction itself. The data suggest that energy conservation instruction may be able to significantly impact the attitudes and behaviors of high school students. More specifically, the data suggest that a strategy of (a) infusing energy conservation in a number of courses, (b) including several hours of instruction, and (c) assigning actual energy conservation activities to students, has the potential for maximizing the impact on conservation attitudes and behaviors. Even keeping in mind the earlier caveat about inferring causality, these findings are very encouraging and suggest that energy and educational policymakers should seriously consider this area of intervention. As McClelland and Canter (1979) point out, even small reductions in energy consumption can be very meaningful when aggregated over thousands of households.

Finally, this report must end with a call for further research. Good experimental research is needed to conclusively demonstrate the causal connection

between education and energy conservation attitudes and behaviors. Furthermore, much work remains to be done in examining and specifying which educational materials and techniques are most effective for these purposes. In addition, there is a need for smaller scale, more intensive examination of the ways in which attitudes and behaviors of teenagers interact with and influence energy consumption patterns in the home. Ultimately one suspects that legislatures and other funding bodies will be most impressed with research that can directly document reductions in household energy consumption. There is a valuable role for psychologists to play in these and other efforts to understand and promote energy conservation. Let us hope that increased support for these endeavors will be forthcoming both from those within the discipline as well as from those policy-makers and funding sources able to impact this social problem area.

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